## **Answers CZ-E-309 & CZ-E-311 NPP Dukovany and Temelín**

"[generic/general]:

1. Screening criteria used in the fire analysis for those NPP that have not explicitly identified these.

Screening criteria used in the fire analysis describes NAR in chapter 2.

2. Defense in Depth (DiD): Regarding the level of fire DiD and the assumptions in the Fire Safety Analyses (FSA) the following questions arise:

a) Has the failure of the fire protection means (features such as structures, systems and equipment, but also human failures in active fire protection) been taken into account in the fire analysis for the safety demonstration of the fire protection structures, systems and components (SSCs)?

b) Both in the deterministic and probabilistic FSA, under which assumptions is this failure considered: full burnout in the fire area and failure of all SSC therein, functions of failure probability for the different SSCs, no damage due to the fire?

c) Under these considerations, do you consider your Fire PSA conservative or realistic?

d) Is the single failure criterion considered in the fire analysis? If it is, on which regulatory basis and how is it considered?

e) Are the spurious actuation of signals by a fire and the false operation of fire protection SCCs considered in the analyses? In what way?

f) Provide information on which combinations of fires and other events have been included in the fire analysis with their justification. Please refer to Appendix I of the IAEA SSG-64 to address possible combinations of events.

g) With regard to these combinations of fires with other events in the analysis, is the failure of the fire protection features (for detection or suppression) caused by combined hazards – such as earthquake and consequential fire or a fire occurring coincidentally with a long-lasting external flooding – considered? What are the qualification requirements ensuring their required function during and after these events?

h) Consideration of the different Plant Operational States (POSs) and/or operating status and modes in the deterministic FSA.

a) In the analysis, it is assumed that the systems are functional and the FP units are operational.

In the deterministic analysis, the burnout of the fire section is calculated, with the fact that the fire must not spread from the affected fire section.

b) PSA considers, in most cases, the failure of all components in the affected fire section. Only for a few fire sections, the PSA model is more detailed and considers different probabilities of component failure in the affected fire section.

In the deterministic analysis, the burnout of the fire section is calculated, with the fact that the fire must not spread from the affected fire section.

c) PSA is conservative.

d) From the point of view of PSA, one of the basic inputs is the frequency of fire occurrence in the given fire section. The frequencies were determined on the basis of knowledge of the given fire sections, equipment in the fire section, fire load, etc. From the point of view of PSA, it does not matter if the fire was caused by a so-called simple fault.

In the deterministic analysis, a simple disturbance is considered. The most complex variant of fire in the building is expected.

e) In the PSA, false activation of signals during a fire, the so-called hot short, is considered, the fire section were assessed as for it. However, the model does not specifically include the false activation of extinguishing systems. Should a false start of an extinguisher cause an equipment inoperability or an initiating event, this will be reflected in the PSA when the PSA data is regularly updated.

The deterministic analysis does not account for false activation of signals and false activity of fire SCCs.

f) In the deterministic analysis, a combination of fires is not considered, but only one fire in the building.

g) A simple failure is expected. A subsequent fire is dealt with in the same way as the initial one.

h) PSA include all NPP states. Fire and its extinguishing is calculated in every unit mode.

3. Fire resistance/fire hazard rating: The fire resistance rating of fire compartments, or fire hazard level, is often determined based on the fire load density (MJ/m²) in every fire area or compartment accounting for both permanent and transient fire loads and potential ignition sources.

a) Provide details on the rationale followed.

b) Fire load criteria values may differ amongst facilities and countries depending on the regulatory framework. How are these respective criteria justified?

c) Are they justified knowing that fires in nuclear facilities are generally under-ventilated?

a) This is a project solution according to ČSN.

b) The criteria are based on the Czech legislation and related binding technical standards – ČSN the majority of which is unified with European standards (EN).

c) This applies to all enclosed spaces. In the Czech standards, a ventilation parameter is calculated, which takes into account the ventilation of the space.

4. Qualification of cables: As far as qualified cables (typically FRNC) are available, in how far are they taken into account as fire load and fire source? How is the qualification of those cables been considered in the fire analysis and for what objective? In how far are protected cables (e.g., protected by protective coatings) considered as contributors to fire propagation in the fire analysis?

If mentioned in the NAR, please confirm that neither strengths nor weaknesses have been identified."

Legislation and standardized requirements determine which cables are included in the fire load and which are not. If the cables are protected by fire coatings and these coatings are serviceable (fire prevention measures), they are not included in the fire load.

5. Transient combustibles and ignition sources: In how far and how have transient combustibles and ignition sources (by e.g. hot works) been included in the fire analysis and what are the hypotheses related to their inclusion?

Temporary combustibles and ignition sources were not included in the analysis as this is managed and registered by the Fire Protection Department – approval is necessary.

6. Direct fire effects: Are direct fire effects (either by smoke, pressure, temperature, soot, etc) onto SSCs important to safety considered in the fire analysis (including reliability of human actions, fire pressure effects on fire doors, fire overpressure effects on cascade flow and pressure gradients of the dynamic confinement system, …)? Some detailed information about the regulatory requirements applicable and the way such effects are taken into account regarding design/conception/construction/modifications would be appreciated.

In fire analyses, it is assumed that the fire that occurs in the fire section will not spread anywhere, which means that the structure, closures, penetrations, dampers and other fire safety equipment is designed to withstand the effects of the fire. Furthermore, it is expected that the equipment in the fire section will be destroyed. Therefore, redundant systems are placed in separate fire sections.

7. Electrical fires: Have electrically induced fires (including fires by high-energy arcing faults, HEAF) been considered in the fire analyses?

Such fires are included in Fire Risk Assessment.

8. Fire Brigade: How have the response times of the fire brigade (onsite, offsite brigades) been taken into account in the fire analysis? This question is more relevant in those installations that do not have a dedicated onsite fire brigade.

The calculation of intervention time is included in Fire Risk Assessment.

9. Radiological consequences of fires: Please provide more details about the methods of addressing the radiological consequences of the fires in the fire analysis and the radiological criteria of acceptance and the corresponding threshold values applicable.

Protective measures are taken to prevent the occurrence of a fire, and if a fire does occur, the fire is detected immediately (within 60 seconds) and the FRSU workers arrive within 3 to 4 minutes of its notification. They will be equipped with appropriate extinguishers according to the firefighting documentation and can extinguish the fire immediately. Extinguishing is not considered in spaces with limited occupancy, where there are large dose rates - storage of highly active radioactive waste, where the fire burns out before unacceptable damage to building structures could occur (closed spaces without the possibility of fresh air intake).

10. Analytical methods:

a) For the installations that do not provide enough detail on the tools and models used in the fire analysis, please provide a more detailed description.

b) In cases where computational tools have been used within fire safety analyses, provide information on the sensitivity and uncertainty analyses carried out.

c) The use of calculation tools is growing. What are your review processes to identify the needs and advantages/disadvantages of adopting such tools? What are the outcomes of these prospects?

d) How are you facing to this (understanding of the corresponding studies by the stakeholders)?

a) Fire analyzes are always analyzed and calculated according to the fire load of each fire section. The values in the table are normative (ČSN).

b) Sensitivity and uncertainty are not reported in fire analyses.

c) Design solution is made strictly according to the Czech legislation and fire protection standards (ČSN).

d) The requirement „safety first“ is on the top level and it is valid as well in fire safety.

11. Operating Experience: Provide a detailed description on if and how the operating experience from both (i) fires and (ii) other events (whether reportable or not) with degradation or failure of fire protection features in the installation analyzed –and, as far as available, also from other nuclear installations– is considered in the fire analysis.

Fire analyzes are always analyzed and calculated according to the fire load of each fire section. The values in the table are normative (ČSN).

12. Additional analyses: Following the accident at the Fukushima NPP, stress tests were defined for European NPP. Has there been followed a similar approach regarding beyond-design-basis fire events for nuclear power plants in your country?

Beyond design fire is not estimated.

13. Results of the Fire Safety Analyses, revisions and actions: Please provide details about:

a) A more elaborated description of the results of the analysis since for some plants the description is not very detailed.

b) Please provide results for the fire contribution to CDF / LRF / LERF.

c) The process carried out to update the fire analysis and the reasons for that.

d) The procedure and responsibilities to design and establish compensatory measures when non-conformities or weaknesses have been identified.

e) The use of the fire analyses by the regulator.

f) The influence of international reviews on the Fire Safety Analysis.

This is described in chapter 2 of NAR.

14. Strengths/weaknesses: In cases that no strengths and weaknesses have been

explicitly

Not identified. Fire protection requirements are strictly regulated as prescribed.